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Preconstruction Air Quality Impact Assessment of the BHP Cabrillo Deepwater Port LNG Import Terminal

prepared for:

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SUMMARY

BHP Billiton LNG International, Inc. (BHP) and EPA Region IX (EPA) are currently assessing the impacts of the proposed Cabrillo Port Offshore LNG Import Terminal (Cabrillo Port). An ambient air impacts analysis was submitted as part of the December 30, 2003 permit application. The modeling has been refined several times to reflect improved project design elements and additional refinements to the analysis that were requested by EPA and BHP. The following modeling analysis was prepared to update the ambient air impacts analysis to reflect BHP's latest refinements to the emission rates.[1]

The modeling analysis is based on predicted maximum Cabrillo Port emissions. NOx, SO_2, CO, and $PM_{10}/PM_{2.5}$ emissions from the stationary source (including the boats in District waters) were modeled using the EPA-approved Offshore and Coastal Dispersion (OCD) Model. The overwater receptor grid extended approximately 22 miles up and down the coast from the FSRU. The overland receptor grid extended two miles inland from the shoreline between Oxnard and Point Dume, and receptors were also placed at 100 meter intervals along the shoreline from Point Dume to the Palos Verdes Peninsula in the South Coast Air Basin (SoCAB). Worst-case impacts were determined at both onshore and offshore receptors. Ambient impacts at the worst-case onshore receptor for each pollutant were well below the federal significance thresholds. For example, NO_2 and PM_{10} levels at the worst-case onshore receptor are expected to be less than 2 percent of the applicable significance thresholds. Based upon this modeling, Cabrillo Port will not materially impact onshore air quality and will not cause or contribute to onshore ambient air quality standard violations.

1.0 AIR QUALITY IMPACT ANALYSIS

1.1 AIR QUALITY MODELING METHODOLOGY

As for the original air quality impact analysis performed for the project in the December 2003 permit application, this update to the air quality impact analysis used the OCD Model. The meteorological data sets used by the model are identical to those used in the December 2005 air quality impact analysis, and had previously been expanded and updated from the three-year data set originally used.[2] The meteorological data sets consist of five years of data collected during 2000–2004. The onshore data were collected by the National Weather Service at the Oxnard Airport. The overwater data were collected by the National Oceanic and Atmospheric Administration (NOAA) at Buoy Station 46025 – Santa Monica Basin. For the overwater data set, mixing heights were set to 500 meters and relative humidity was set to 80%. The original ambient air impacts analysis had been further revised to include potential effects of platform downwash using the same FSRU dimensions that were used for the screening analysis for

[1] Revised emissions estimates are being submitted under separate cover.
[2] Onshore, Ventura-Emma Wood State Beach (from Ventura County Air Pollution Control District); offshore, NOAA Buoy Station 46025.

ammonia impacts. The OCD model was recompiled to allow the use of up to 50,000 receptors per run. No changes to the model or meteorological data have been made since the December 2005 submittal.

1.2 PROJECT EMISSIONS

Initial estimates of the project's emissions were included in the December 2003 application. Since that time, BHP has revised downward the estimated emissions attributable to certain of the sources as the result of utilization of equipment that will meet the Tier 2 non-road diesel emission standards. In addition, the stationary source emissions were revised to include natural gas-fueled support vessel operations in District waters.

The current analysis reflects new and generally lower emission rates provided to BHP by Wartsila for the main generators and the support tug engines. The revised emission rates were used in this air quality impact analysis. Table 1-1 below summarizes the revised emissions from the sources located on the FSRU and from vessel operations in District waters.

Table 1-1
Cabrillo Port Operational Emissions Summary

	Emissions, tons per year				
Description	**NOx**	**ROC**	**CO**	**SO_2**	**$PM_{10}/PM_{2.5}$[a]**
Stationary Source (FSRU)					
Wartsila 9L50DF Main Generators	12.2	24.5	20.8	0.07	8.1
Wartsila 9L50DF Backup Generator	1.9	0.3	0.2	<0.1	0.1
Submerged Combustion Vaporizers	48.9	3.5	148.9	0.33	3.8
Emergency Fire Pump and Generator	3.0	0.4	1.9	<0.1	0.1
Freefall Lifeboat	<0.1	<0.1	<0.1	<0.1	<0.1
Diesel Fuel Storage Tank	-0-	<0.1	-0-	-0-	-0-
Total Stationary Source	**66.1**	**28.7**	**171.7**	**0.41**	**12.1**
Marine Vessels, District Waters[b]					
Tug Supply Boats	0.3	0.1	0.4	<0.1	<0.1
Crew Boat	0.3	0.1	0.3	<0.1	<0.1
Subtotal, District Waters	**0.6**	**0.2**	**0.7**	**<0.1**	**<0.1**

Notes:
a. All PM_{10} assumed to be $PM_{2.5}$.
b. District waters extend approximately 3.5 miles from shoreline.

The activity data on which these emissions calculations are based are being provided to the agencies by the applicant under separate cover. These activity data were also the basis for calculation of emissions over shorter periods to allow comparison of modeled impacts with short-term ambient air quality standards. The emission rates used in the modeling analysis are shown in the appendix.

1.3 AIR QUALITY IMPACT ANALYSIS

1.3.1 Receptor Locations

The overwater receptor grid extended approximately 22 miles up and down the coast from the FSRU. The overland receptor grid extended two miles inland from the shoreline with additional receptors in the Oxnard area. Additional receptors were placed along the shoreline of the South Coast Air Basin from Point Dume to the Palos Verdes peninsula.

Receptors have been excluded from a 500-meter exclusion zone surrounding the FSRU. Under federal law (33 CFR 165.2 Subpart C, Safety Zones), a safety zone is an area "to which for safety or environmental purposes, access is limited to authorized persons, vehicles, or vessels. It may be stationary and described by fixed limits or it may be described as a zone around a vessel in motion." The Applicant has requested from the U.S. Coast Guard a safety zone with a radius of 500 meters from the outer edge of the FSRU. If the project is approved, the safety zone will be added to navigation charts as a limited access area only, established in accordance with 33 CFR Part 150. Only LNG carriers bound for the FSRU and service and supply vessels associated with the FSRU and LNG carrier operations would be allowed to enter the safety zone. By federal law, the general public would no longer have access to this area. The safety zone would be rigorously patrolled to prevent the incursion of unauthorized personnel.

This exclusion is consistent with the December 19, 1980 letter from Douglas Costle to Senator Jennings Randolph stating that an "exemption from ambient air is available only for the atmosphere over land owned or controlled by the source and to which public access is precluded by a fence or other physical barriers." This exemption was further clarified in an April 30, 1987 letter from G.T. Helms of OAQPS to Steve Rothblatt, Chief of the Region V Air Division, stating that receptors must be placed in a river that is a public waterway because it is not controlled by the source. However, the letter also lays out the conditions under which the adjacent riverbank may be excluded from ambient air: '[t]he riverbank must be clearly posted and regularly patrolled by plant security. It must be very clear that the area is not public." Because the safety zone is an area that will be controlled by the source, clearly posted on navigational charts, and rigorously patrolled, the general public will not have access to the area and the safety zone is not considered to be ambient air. This approach is consistent with the way in which EPA Region 6 handled the safety zone for the El Paso Energy Bridge (now, Gulf Gateway Energy Bridge). In that situation, EPA recognized that the general public is excluded from the safety zone and so the area within the safety zone does not meet the definition of "ambient air."

1.3.2 Results of the Air Quality Impact Analysis

Results of the air quality modeling analysis are summarized in Tables 1-2 through 1-5. Tables 1-2 and 1-3 compare the maximum modeled concentrations from project emissions to the PSD significance thresholds and Class II increments. Stationary source impacts and stationary source plus marine vessel impacts are shown separately. These tables also show that with the exception of annual average NO_2, all project impacts are well below all significance thresholds. The area in which the modeled annual average NO_2 concentrations exceed the significant impact level extends less than 1100 meters to the east of the Coast Guard exclusion zone, immediately adjacent to the FSRU and located over 10 miles from any onshore receptors.

Table 1-3 shows that the inclusion in the air quality impact analysis of marine vessel activity in District waters has very little impact on the modeled impacts from the proposed project. Because the support vessels operate infrequently and for short periods of time in District waters, their contribution to maximum modeled impacts is minimal. Eight-hour average NOx concentrations are presented in lieu of ozone modeling; this issue is discussed in greater detail below.

Tables 1-4 and 1-5 show the maximum modeled offshore and onshore impacts from the project combined with representative background pollutant concentrations, respectively, and compare these total projected impacts with the federal ambient air quality standards. With the exception of the addition of $PM_{2.5}$ data and updating of PM_{10} data, background concentrations are the same as those presented in the original PSD application. These results show that with the exception of offshore annual NO_2 impacts, emissions from the proposed FSRU would not cause or contribute to any violations of any federal ambient air quality standard. EPA has stated that it is its longstanding policy to use significant impact levels to determine whether a proposed new or modified source will cause or contribute to a violation of the national ambient air quality standards (NAAQS) or PSD increments. If a source's maximum impacts are below the significant impact levels, then the source is judged to not cause or contribute significantly to a NAAQS or increment violation. As the onshore impacts are significantly below the significant impact levels for each pollutant, the project will not cause or contribute to a NAAQS or increment violation onshore.

The District consists of both attainment and nonattainment areas. Anacapa Island and San Nicolas Island are within the District boundaries and are designated as attainment for all federal standards. The portion of the County on the mainland is designated as a moderate nonattainment area for ozone and as an attainment area for all other federal standards. The project is essentially the same distance from Anacapa Island as the mainland. In Figures 1-7 through 1-10 it can be seen that the impacts to Anacapa Island from the combined FSRU source and marine vessel emissions are less than or equal to the impacts on the mainland for all pollutants. Therefore, the conclusions in this report regarding onshore impacts apply to Anacapa Island as well.

Table 1-2
Comparison of Maximum Modeled Stationary Source Impacts with PSD Significance Thresholds and Class II Increments

Pollutant	Avg Period	Max. Modeled Offshore Impact ($\mu g/m^3$)	Max. Modeled Onshore Impact ($\mu g/m^3$)	Max. Modeled Impact in SoCAB ($\mu g/m^3$)[a]	PSD Significance Threshold ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
NO_2[b]	8-hour[c]	23.9	1.5	0.6	--	--
	annual	2.1	0.015	0.015	1.0	25
SO_2	3-hour	0.2	0.02	0.01	25	325
	24-hour	0.1	<0.01	<0.01	5	91
	annual	0.01	<0.01	<0.01	1.0	20
CO	1-hour	155.3	37.2	10.4	2,000	--
	8-hour	64.8	3.6	1.3	500	--
$PM_{10}/PM_{2.5}$	24-hour	0.8	0.1	0.03	5	30
	annual	0.2	<0.01	<0.01	1.0	17

Note: a. See Figure 1-16 for locations of SoCAB receptors.
b. To be conservative, all NOx is assumed to be NO_2 in evaluating ambient impacts.
c. 8-hr average NO_2 concentration is modeled for use in estimating project ozone impacts.

Table 1-3
Comparison of Maximum Modeled Project Impacts with PSD Significance Thresholds and Class II Increments (Stationary Sources and Marine Vessels)

Pollutant	Avg Period	Max. Modeled Offshore Impact ($\mu g/m^3$)	Max. Modeled Onshore Impact ($\mu g/m^3$)	Max. Modeled Impact in SoCAB ($\mu g/m^3$)	PSD Significance Threshold ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
NO_2[a]	8-hour[b]	23.9	1.5	0.6	--	--
	annual	2.1	0.015	0.015	1.0	25
SO_2	3-hour	0.2	0.02	0.01	25	325
	24-hour	0.1	<0.01	<0.01	5	91
	annual	0.01	<0.01	<0.01	1.0	20
CO	1-hour	155.3	37.2	10.4	2,000	--
	8-hour	64.8	3.7	1.3	500	--
$PM_{10}/PM_{2.5}$	24-hour	0.8	0.1	0.03	5	30
	annual	0.2	<0.01	<0.01	1.0	17

Note: a. To be conservative, all NOx is assumed to be NO_2 in evaluating ambient impacts.
b. 8-hr average NO_2 concentration is modeled for use in estimating project ozone impacts.

Table 1-4
Comparison of Maximum Modeled Offshore Project Impacts with Ambient Air Quality Standards

Pollutant	Avg Period	Max. Modeled Offshore Impact ($\mu g/m^3$)	Background Conc. ($\mu g/m^3$)[a]	Total Impact ($\mu g/m^3$)	State Standard ($\mu g/m^3$)	Federal Standard ($\mu g/m^3$)
NO_2	annual	2.1	26	28	--	100
SO_2	3-hour	0.2	39	39	--	1,300
	24-hour	0.1	31	31	105	365
	annual	0.01	10	10	--	80
CO	1-hour	155.3	8,469	8,624	23,000	40,000
	8-hour	64.8	4,921	4,986	10,000	10,000
PM_{10}	24-hour	0.8	124	125	50	150
	annual	0.2	29	29	20	50
$PM_{2.5}$	24-hour	0.8	32[b]	33	--	65
	annual	0.2	13	13	12	15

Note: [a] Background values for NO_2, SO_2, PM_{10}, and $PM_{2.5}$ from El Rio monitoring station for 2002 (Station ID No. 061113001). Background values for CO from Ventura-Emma Wood State Beach monitoring station (Station ID No. 061112003).
[b] Background values for $PM_{2.5}$ based on 98th percentile.

Table 1-5
Comparison of Maximum Modeled Onshore Project Impacts with Ambient Air Quality Standards

Pollutant	Avg Period	Max. Modeled Onshore Impact ($\mu g/m^3$)	Background Conc. ($\mu g/m^3$)[a]	Total Impact ($\mu g/m^3$)	State Standard ($\mu g/m^3$)	Federal Standard ($\mu g/m^3$)
NO_2	annual	0.015	26	26	--	100
SO_2	3-hour	0.02	39	39	--	1,300
	24-hour	<0.01	31	31	105	365
	annual	<0.01	10	10	--	80
CO	1-hour	37.2	8,469	8,506	23,000	40,000
	8-hour	3.6	4,921	4,925	10,000	10,000
PM_{10}	24-hour	0.1	124	124	50	150
	annual	<0.01	29	29	20	50
$PM_{2.5}$	24-hour	0.1	32[b]	32	--	65
	annual	<0.01	13	13	12	15

Note: [a] Background values for NO_2, SO_2, PM_{10}, and $PM_{2.5}$ from El Rio monitoring station for 2002 (Station ID No. 061113001). Background values for CO from Ventura-Emma Wood State Beach monitoring station (Station ID No. 061112003).
[b] 24-hour average background value for $PM_{2.5}$ based on 98th percentile.

Tables 1-2 and 1-3 show that the maximum project impacts for all pollutants and averaging periods occur at sea and outside District waters. Modeled impacts for all pollutants and averaging periods are much lower onshore. Figures 1-1 through 1-3 and 1-7 through 1-9 show the modeled impacts of annual NO_2 and 24-hour and annual $PM_{10}/PM_{2.5}$ from the stationary sources on the FSRU alone and from the FSRU sources and the associated marine vessel activity in the vicinity of the project, respectively. Figures 1-4 through 1-6 and 1-10 through 1-12 show the onshore impacts for NOx and $PM_{10}/PM_{2.5}$ for the FSRU sources alone and in combination with the marine vessels in greater detail. Figure 1-13 shows the locations of the receptors used in the modeling analysis upon which Figures 1-1 through 1-12 are based. Figure 1-14 shows the locations of the receptors used to evaluate impacts of the project in the South Coast Air Basin.

Figures 1-15 through 1-20 show the modeled impacts of annual NO_2 and 24-hour and annual $PM_{10}/PM_{2.5}$ from the stationary sources on the FSRU alone and from the FSRU sources and the associated marine vessel activity along the coastline of the South Coast Air Basin and compare these modeled impacts to the national ambient air quality standards.

2.0 ASSESSMENT OF SIGNIFICANCE

2.1 SIGNIFICANCE COMPARISON TABLES

In the following tables, the maximum onshore ambient air quality impacts of the Cabrillo Port LNG facility are compared with the relevant federal concentration-based significance criteria for each pollutant.

2.1.1 Nitrogen Dioxide

Table 2.1 compares the maximum modeled NO_2 impacts from the proposed project with the ambient air quality standards and the Class I and Class II significant impact levels for NOx. EPA specifies that a major source will not be considered to cause or contribute to a violation of a national ambient air quality standard if the ambient impacts attributable to that major source are less than or equal to the Class II significance levels at any locality that does not or would not meet the applicable national standard. 40 CFR § 51.165(b)(2). Ventura County, in its entirety, is an attainment area for the federal NO_2 standard. Impacts below the significant impact levels demonstrate that the project will have inconsequential impacts to onshore air quality.

Comparison of the modeling results at the worst-case receptors to the significant impact levels indicates that the project will not have a material effect upon air quality. None of the onshore impact levels exceed the Class II NO_2 significance level of 1.0 $\mu g/m^3$; maximum predicted impacts are approximately two orders of magnitude below the significance threshold. Therefore, the facility is not expected to cause or contribute to an onshore violation of the NO_2 ambient air quality standard. The maximum modeled offshore impact is 2.1 $\mu g/m^3$, which is above the Class II area significant impact level (SIL). However, as discussed

above and as shown in Figures 1-1 and 1-7, the area in which the modeled annual average NO_2 concentrations exceed the SIL extends less than 1100 meters to the east of the Coast Guard exclusion zone, immediately adjacent to the FSRU and located over 10 miles from any onshore receptors. Because the significant impact is so localized and so far from any other onshore or offshore sources, it is unlikely that any other emission sources would impact the SIL. Therefore, the applicant does not believe that an NO_2 increment analysis is appropriate or necessary for this project.

Table 2-1
Assessment of Significance for Impacts of Oxides of Nitrogen

Measure of Significance	Level	Maximum Modeled Concentration, $\mu g/m^3$	
		Offshore	Onshore
National AAQS	100 $\mu g/m^3$	2.1	0.015
Class II SIL	1.0 $\mu g/m^3$	2.1	0.015
Class II increment	25 $\mu g/m^3$	2.1	0.015
Class I SIL	0.1 $\mu g/m^3$	2.1	0.015
Class I increment	2.5 $\mu g/m^3$	2.1	0.015

2.1.2 Ozone

There are no approved air quality models for evaluating the ozone impacts of an individual project. However, the OCD modeling results and the unique attributes of the proposed project demonstrate that there is insignificant potential for the proposed project to impact the onshore ozone nonattainment area.

The proposed project's onshore NO_2 impacts are too small to materially contribute to ozone formation. The proposed project's annual NO_2 impacts are nearly two orders of magnitude below the Class II significant impact level. The proposed project's short-term worst-case offshore NOx impact would be approximately 23.9 $\mu g/m^3$ (8-hour average). The proposed project's short-term worst-case onshore NOx impact would be approximately 1.5 $\mu g/m^3$ (8-hour average).

Based upon the minimal NO_2 impacts that will be experienced at the shoreline, the proposed project is not expected to cause or materially contribute to any onshore violation of the ozone standard.

2.1.2 Carbon Monoxide

Table 2-2 compares the modeled CO impacts from the proposed project with the ambient air quality standards and the Class II significant impact levels. EPA specifies that a major source will be considered to cause or contribute to a

violation of a national ambient air quality standard if the ambient impacts attributable to that major source exceed the Class II significance levels at any locality that does not or would not meet the applicable national standard. 40 CFR § 51.165(b)(2). Ventura County, in its entirety, is an attainment area for the federal CO standards. Impacts below the significant impact levels demonstrate that the project will have inconsequential impacts on onshore air quality.

A comparison of the modeling results at the worst-case receptors to the significant impact levels indicates that the project will not have a material effect upon air quality. None of the impact levels exceed the CO significance levels of 500 µg/m^3 (8-hour average) or 2,000 µg/m^3 (1-hour average). Therefore, the facility is not expected to cause or contribute to any on-shore violation of the CO ambient air quality standard.

Table 2-2
Assessment of Significance for Impacts of Carbon Monoxide

Measure of Significance	Level	Maximum Modeled Concentration, µg/m^3	
		Offshore	Onshore
National AAQS – 1 hr	40,000 µg/m^3	155.3	37.2
National AAQS – 8 hr	10,000 µg/m^3	64.8	3.6
Class II SIL – 1 hr	2,000 µg/m^3	155.3	37.2
Class II SIL – 8 hr	500 µg/m^3	64.8	3.6

2.1.3 Sulfur Dioxide

Table 2-3 compares the modeled SO_2 emission impacts from the proposed project to the ambient air quality standards and the Class I and Class II significant impact levels. EPA specifies that a major source will be considered to cause or contribute to a violation of a national ambient air quality standard if the ambient impacts attributable to that major source exceed the Class II significance levels at any locality that does not or would not meet the applicable national standard. 40 CFR § 51.165(b)(2). Ventura County, in its entirety, is an attainment area for the federal SO_2 standards. Impacts below the significant impact levels demonstrate that the project will have inconsequential impacts to air quality.

A comparison of the modeling results at the worst-case receptors to the significant impact levels indicates that the project will not have a material effect upon air quality. None of the impact levels exceed the Class II SO_2 significance levels of 1 µg/m^3 (annual average), 5 µg/m^3 (24-hour average) or 25 µg/m^3 (3-hour average). Therefore, the facility is not expected to cause or contribute to any violation of the SO_2 ambient air quality standard.

Table 2-3
Assessment of Significance for Impacts of Sulfur Dioxide

Measure of Significance	Level	Maximum Modeled Concentration, $\mu g/m^3$	
		Offshore	Onshore
National AAQS – 3 hr	1300 $\mu g/m^3$	0.2	0.02
National AAQS – 24 hr	365 $\mu g/m^3$	0.1	<0.01
National AAQS – annual	80 $\mu g/m^3$	0.01	<0.01
Class II SIL – 3 hr	25 $\mu g/m^3$	0.2	0.02
Class II SIL – 24 hr	5 $\mu g/m^3$	0.1	<0.01
Class II SIL – annual	1.0 $\mu g/m^3$	0.01	<0.01
Class I SIL – 3 hr	1.0 $\mu g/m^3$	0.2	0.02
Class I SIL – 24 hr	0.2 $\mu g/m^3$	0.1	<0.01
Class I SIL – annual	0.1 $\mu g/m^3$	0.01	<0.01

2.1.4 Fine Particulates

Table 2-4 compares the ambient PM_{10} emission impacts from the proposed project to the ambient air quality standards and the Class I and Class II significant impact levels. EPA specifies that a major source will be considered to cause or contribute to a violation of a national ambient air quality standard if the ambient impacts attributable to that major source exceed the Class II significance levels at any locality that does not or would not meet the applicable national standard. 40 CFR § 51.165(b)(2). Ventura County, in its entirety, is an attainment area for the federal PM_{10} and $PM_{2.5}$ standards. Impacts below the significant impact levels demonstrate that the project will have inconsequential impacts to onshore air quality.

A comparison of the modeling results at the worst-case receptors to the significant impact levels indicates that the project will not have a material effect upon air quality. None of the impact levels exceed the Class II PM_{10} significance levels of 1 $\mu g/m^3$ (annual average) or 5 $\mu g/m^3$ (24-hour average). While significance levels have yet to be developed for $PM_{2.5}$, the combination of onshore attainment status and the extremely low ambient impacts indicate that the proposed project will have an insignificant effect upon air quality. Therefore, the facility is not expected to cause or contribute to any on-shore violation of the PM_{10} or $PM_{2.5}$ ambient air quality standards.

Table 2-4
Assessment of Significance for Impacts of Fine Particulates (PM_{10})

Measure of Significance	Level	Maximum Modeled Concentration, $\mu g/m^3$	
		Offshore	Onshore
National AAQS – 24 hr	150 $\mu g/m^3$	0.8	0.1
National AAQS – annual	50 $\mu g/m^3$	0.2	<0.01
Class II SIL –24 hr	5 $\mu g/m^3$	0.8	0.1
Class II SIL – annual	1 $\mu g/m^3$	0.2	<0.01
Class I SIL – 24 hr	0.3 $\mu g/m^3$	0.8	0.1
Class I SIL – annual	0.2 $\mu g/m^3$	0.2	<0.01

Table 2-5
Assessment of Significance for Impacts of Fine Particulates ($PM_{2.5}$)

Measure of Significance	Level	Maximum Modeled Concentration, $\mu g/m^3$	
		Offshore	Onshore
National AAQS – 24 hr	65 $\mu g/m^3$	0.8	0.1
National AAQS – annual	15 $\mu g/m^3$	0.2	<0.01

2.2 AMBIENT AIR QUALITY IMPACTS

As shown in the modeling results presented in Section 1, the ambient impacts attributable to the proposed project are expected to be less than the significant impact levels at the worst-case receptors for all pollutants and averaging periods except annual NO_2, and lower still onshore. The area in which the modeled annual average NO_2 concentrations exceed the SIL extends less than 1100 meters to the east of the coast Guard exclusion zone, immediately adjacent to the FSRU and located over 10 miles from any onshore receptors. As a result, the operation of the proposed project will not cause or contribute to exceedances of the NAAQS for any pollutant. Accordingly, the Cabrillo Port LNG Terminal will not have a material impact on onshore ambient air quality.

2.3 OVERALL ASSESSMENT OF SIGNIFICANCE

The analysis of impacts on air quality on and offshore within 22 miles of the facility shows that the operation of the Cabrillo Port LNG Terminal will not cause or contribute to violations of the NAAQS. Further, considering the location and extent of the maximum modeled concentrations, these impacts are not considered to be significant when compared with relevant measures of significance.

APPENDIX 1

EMISSION RATES AND STACK PARAMETERS FOR MODELING

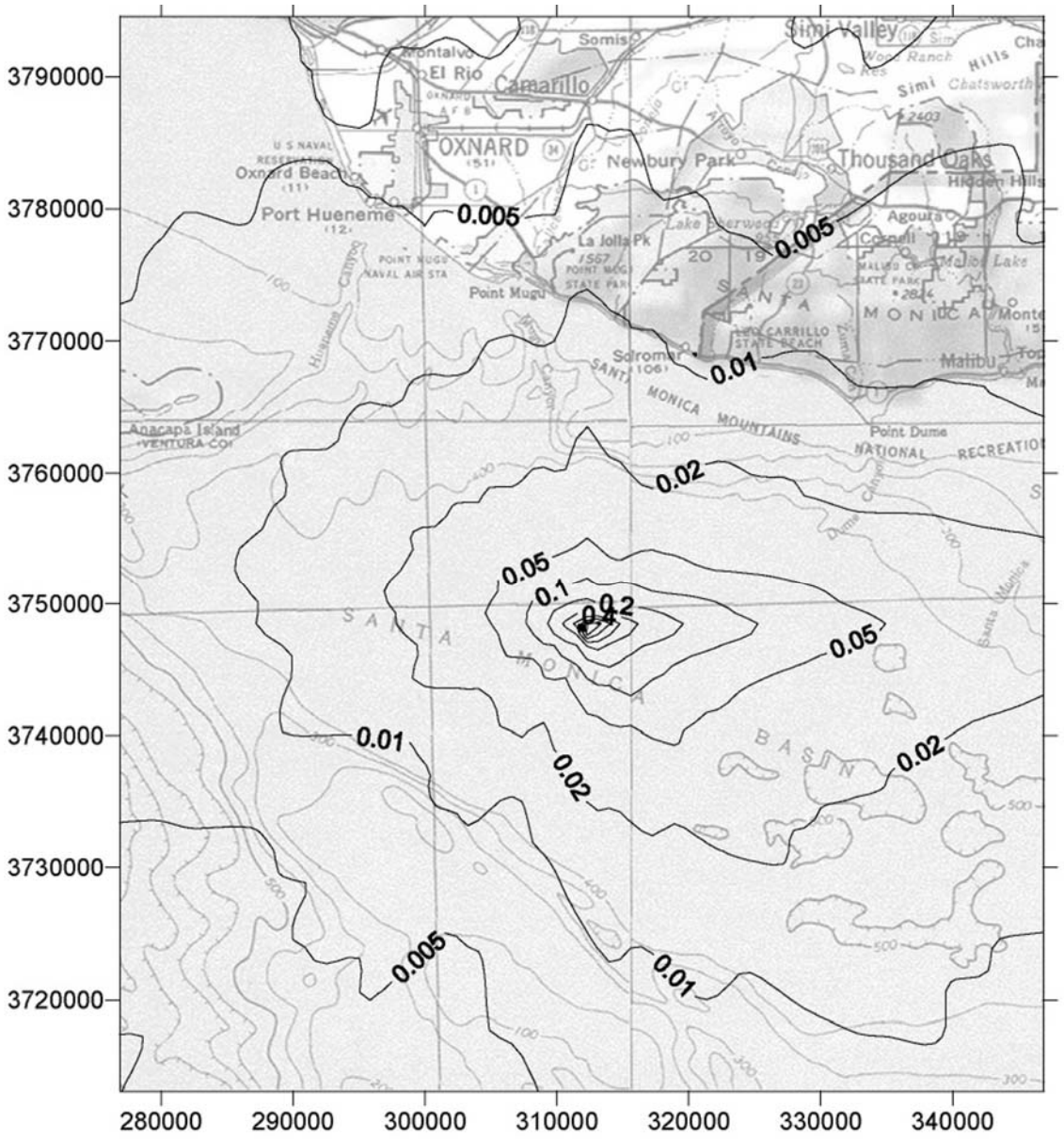
Emission Rates and Stack Parameters for Refined Modeling
BHP Cabrillo LNG Deepwater Port: FSRU Sources

	Stack Diam, m	Stack Height, m	Exh Temp, Deg K	Exhaust Flow, m3/s	Exhaust Velocity, m/s	Emission Rate, g/s NOx	SO2	CO	PM10
Averaging Period: 1 hour									
Main generators (total)	1.732	33.000	699.67	126.38	53.637	0.688	0.004	1.169	n/a
Vaporizers (total)	2.000	35.000	294.11	44.994	14.322	1.407	0.010	4.284	n/a
Emergency generator	0.660	25.000	699.67	24.591	71.792	6.533	0.007	4.083	n/a
Fire pump	0.254	25.000	699.67	4.015	79.235	0.933	0.001	0.583	n/a
Life boat	0.076	1.000	699.67	0.437	95.864	0.101	0.000	0.078	n/a
Averaging Period: 3 hours									
Main generators (total)	1.732	33.000	699.67	126.38	53.637	n/a	3.965E-03	n/a	n/a
Vaporizers (total)	2.000	35.000	294.11	44.994	14.322	n/a	9.555E-03	n/a	n/a
Emergency generator	0.660	25.000	699.67	24.591	71.792	n/a	2.340E-03	n/a	n/a
Fire pump	0.254	25.000	699.67	4.015	79.235	n/a	3.820E-04	n/a	n/a
Life boat	0.076	1.000	699.67	0.437	95.864	n/a	4.159E-05	n/a	n/a
Averaging Period: 8 hours									
Main generators (total)	1.732	33.000	699.67	126.38	53.637	0.688	n/a	1.169	n/a
Vaporizers (total)	2.000	35.000	294.11	44.994	14.322	1.407	n/a	4.284	n/a
Emergency generator	0.660	25.000	699.67	24.591	71.792	0.817	n/a	0.510	n/a
Fire pump	0.254	25.000	699.67	4.015	79.235	0.117	n/a	0.073	n/a
Life boat	0.076	1.000	699.67	0.437	95.864	0.013	n/a	0.010	n/a
Averaging Period: 24 hours									
Main generators (total)	1.732	33.000	699.67	126.38	53.637	n/a	3.965E-03	n/a	0.455
Vaporizers (total)	2.000	35.000	294.11	44.994	14.322	n/a	9.555E-03	n/a	0.109
Emergency generator	0.660	25.000	699.67	24.591	71.792	n/a	2.924E-04	n/a	0.010
Fire pump	0.254	25.000	699.67	4.015	79.235	n/a	4.775E-05	n/a	1.389E-03
Life boat	0.076	1.000	699.67	0.437	95.864	n/a	5.199E-06	n/a	2.593E-04
Averaging Period: Annual									
Main generators (total)	1.732	33.000	699.67	126.38	53.637	0.352	2.028E-03	n/a	0.233
Vaporizers (total)	2.000	35.000	294.11	44.994	14.322	1.407	9.555E-03	n/a	0.109
Emergency generator	0.660	25.000	699.67	24.591	71.792	0.075	8.012E-05	n/a	2.664E-03
Fire pump	0.254	25.000	699.67	4.015	79.235	0.011	1.308E-05	n/a	3.805E-04
Life boat	0.076	1.000	699.67	0.437	95.864	2.886E-07	3.561E-10	n/a	3.552E-05

Emission Rates and Stack Parameters for Refined Modeling
BHP Cabrillo LNG Deepwater Port: Vessels in District Waters

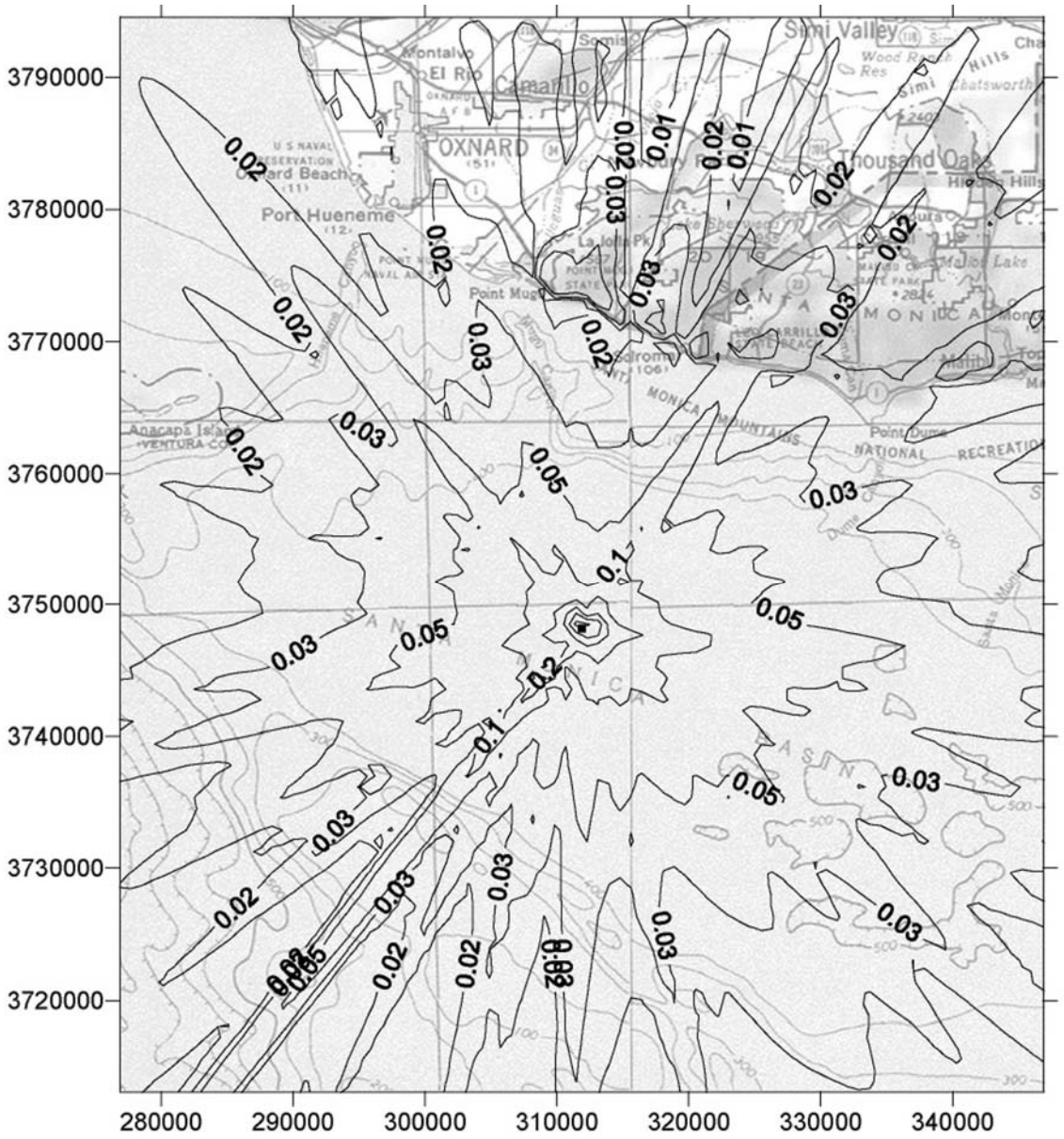
	Effective Stack Diam, m	Stack Height, m	Exh Temp, Deg K	Exhaust Flow, m3/s	Exhaust Velocity, m/s	Emission Rate, g/s NOx	SO2	CO	PM10
Averaging Period: 1 hour									
Tug Supply	0.777	9.000	699.67	14.71	31.009	n/a	n/a	1.809	n/a
Crew Boat	0.330	5.000	699.67	2.30	26.917	n/a	n/a	0.199	n/a
Averaging Period: 3 hours									
Tug Supply	0.777	9.000	699.67	14.71	31.009	n/a	2.456E-04	n/a	n/a
Crew Boat	0.330	5.000	699.67	2.30	26.917	n/a	1.965E-05	n/a	n/a
Averaging Period: 8 hours									
Tug Supply	0.777	9.000	699.67	14.71	31.009	0.313	n/a	0.452	n/a
Crew Boat	0.330	5.000	699.67	2.30	26.917	0.027	n/a	0.025	n/a
Averaging Period: 24 hours									
Tug Supply	0.777	9.000	699.67	14.71	31.009	n/a	6.141E-05	n/a	5.486E-03
Crew Boat	0.330	5.000	699.67	2.30	26.917	n/a	4.913E-06	n/a	2.978E-04
Averaging Period: Annual									
Tug Supply	0.777	9.000	699.67	14.71	31.009	0.007	4.374E-06	n/a	3.908E-04
Crew Boat	0.330	5.000	699.67	2.30	26.917	0.009	2.450E-06	n/a	1.485E-04

Figure 1-1
BHP Cabrillo LNG Deepwater Port
Annual Average NO_2 Impacts: FSRU Sources Only
Maximum Modeled Impacts



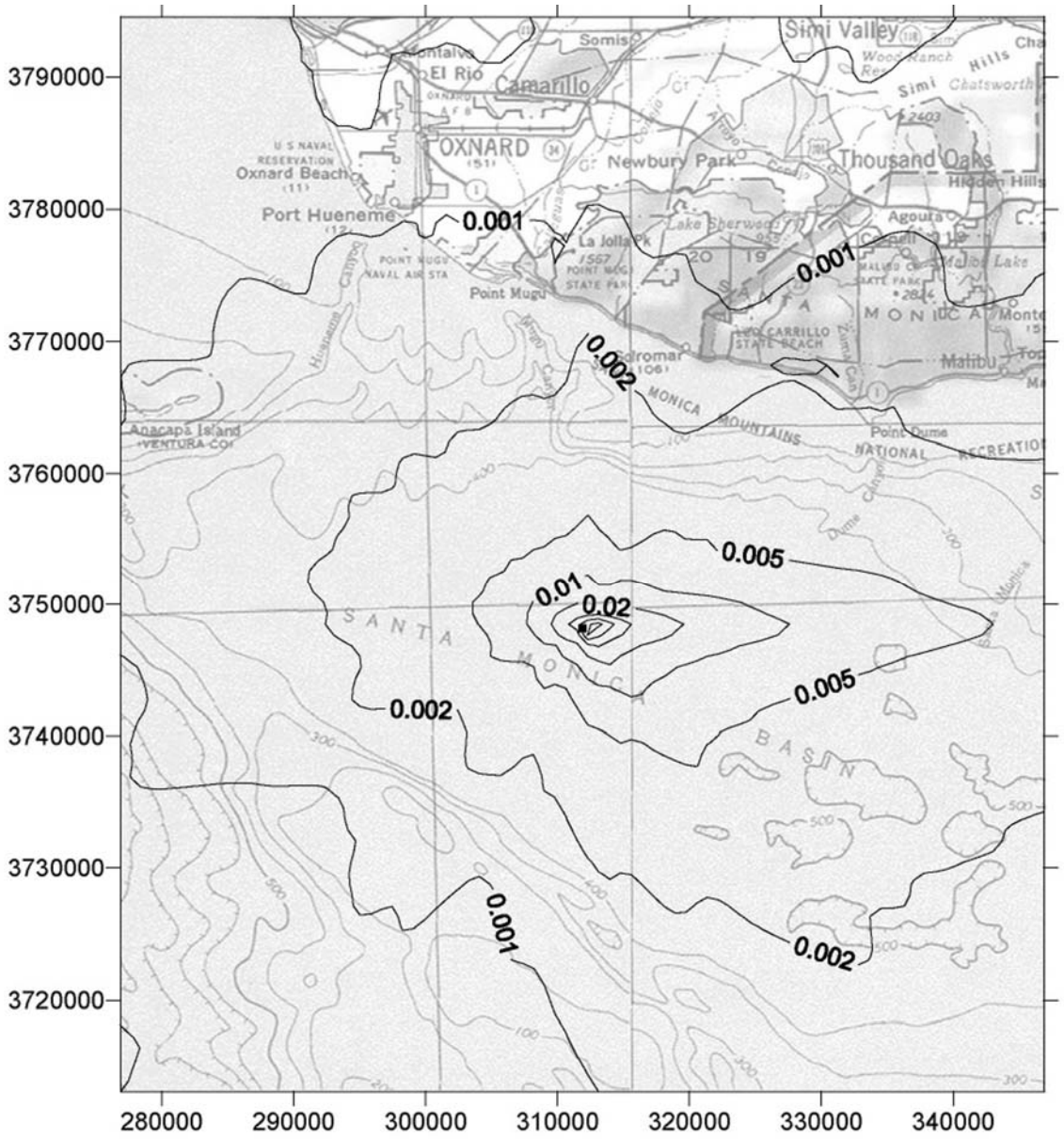
Note: Lines show contours of constant concentration; impacts are in units of $\mu g/m^3$.

Figure 1-2
BHP Cabrillo LNG Deepwater Port
24-hr Average PM_{10} Impacts: FSRU Sources Only
Maximum Modeled Impacts



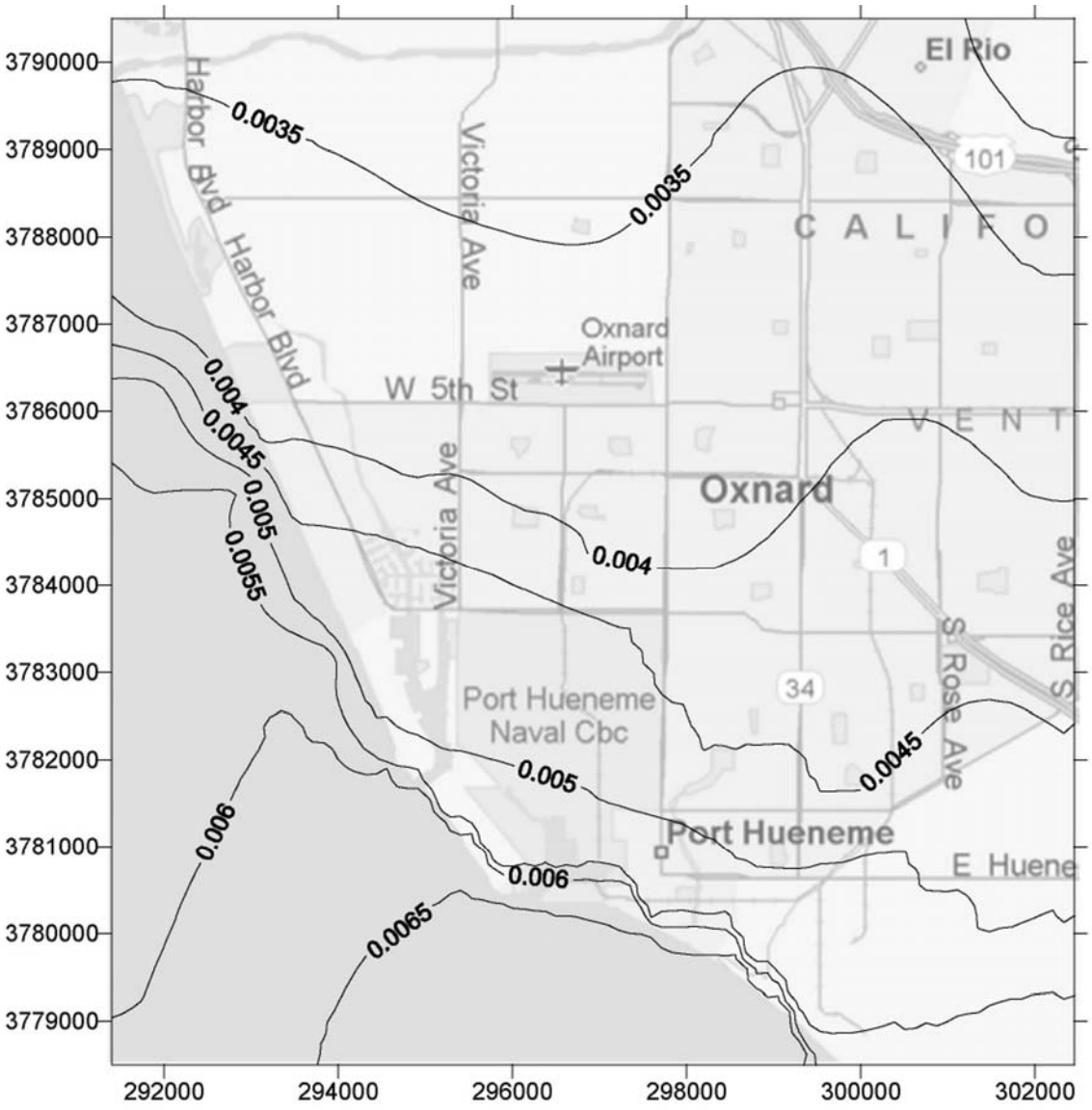
Note: Lines show contours of constant concentration; impacts are in units of $\mu g/m^3$.

Figure 1-3
BHP Cabrillo LNG Deepwater Port
Annual Average PM_{10} Impacts: FSRU Sources Only
Maximum Modeled Impacts



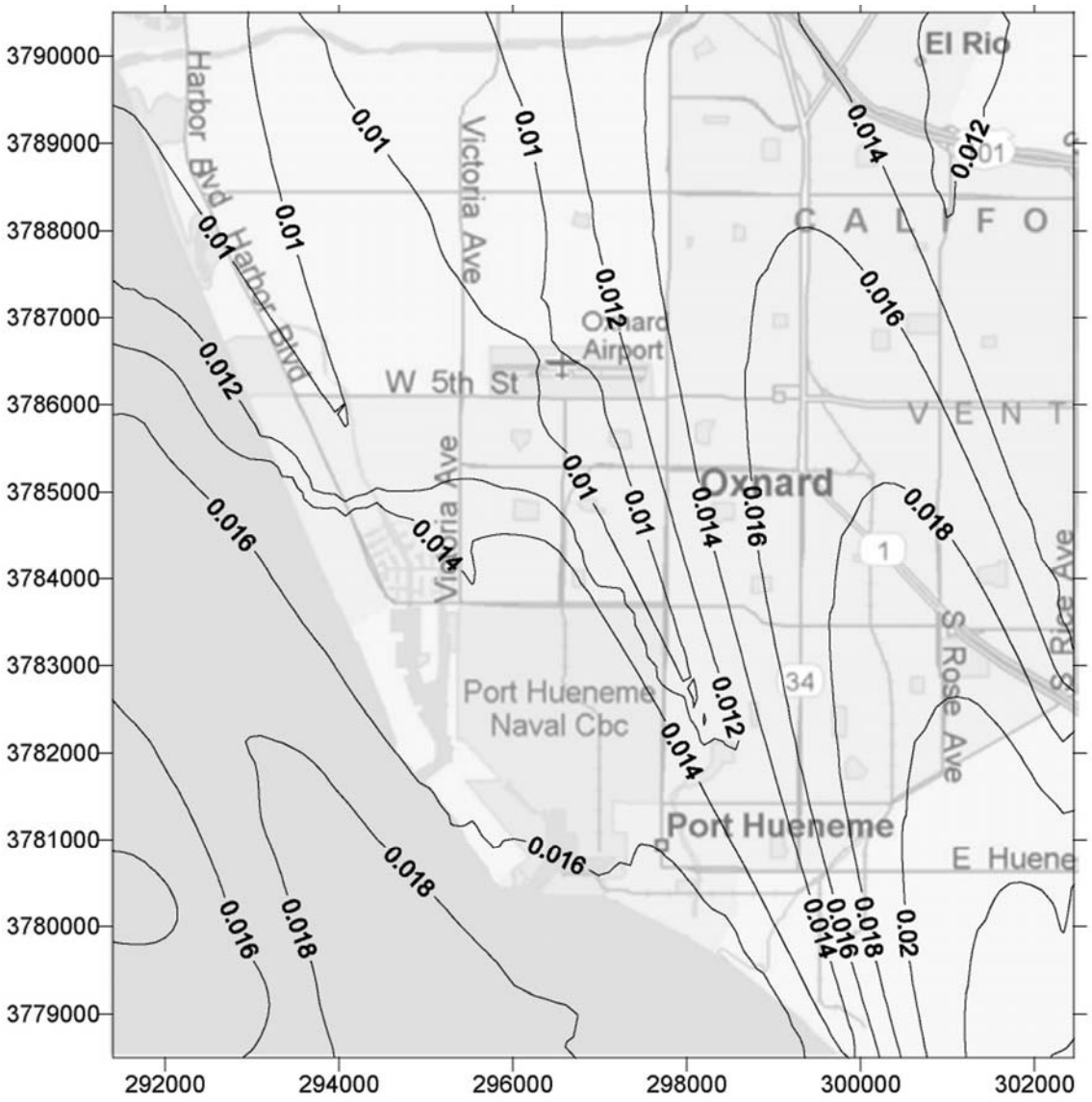
Note: Lines show contours of constant concentration; impacts are in units of $\mu g/m^3$.

Figure 1-4
BHP Cabrillo LNG Deepwater Port
Annual Average NO_2 Impacts: FSRU Sources Only
Maximum Modeled Impacts Over Oxnard Area



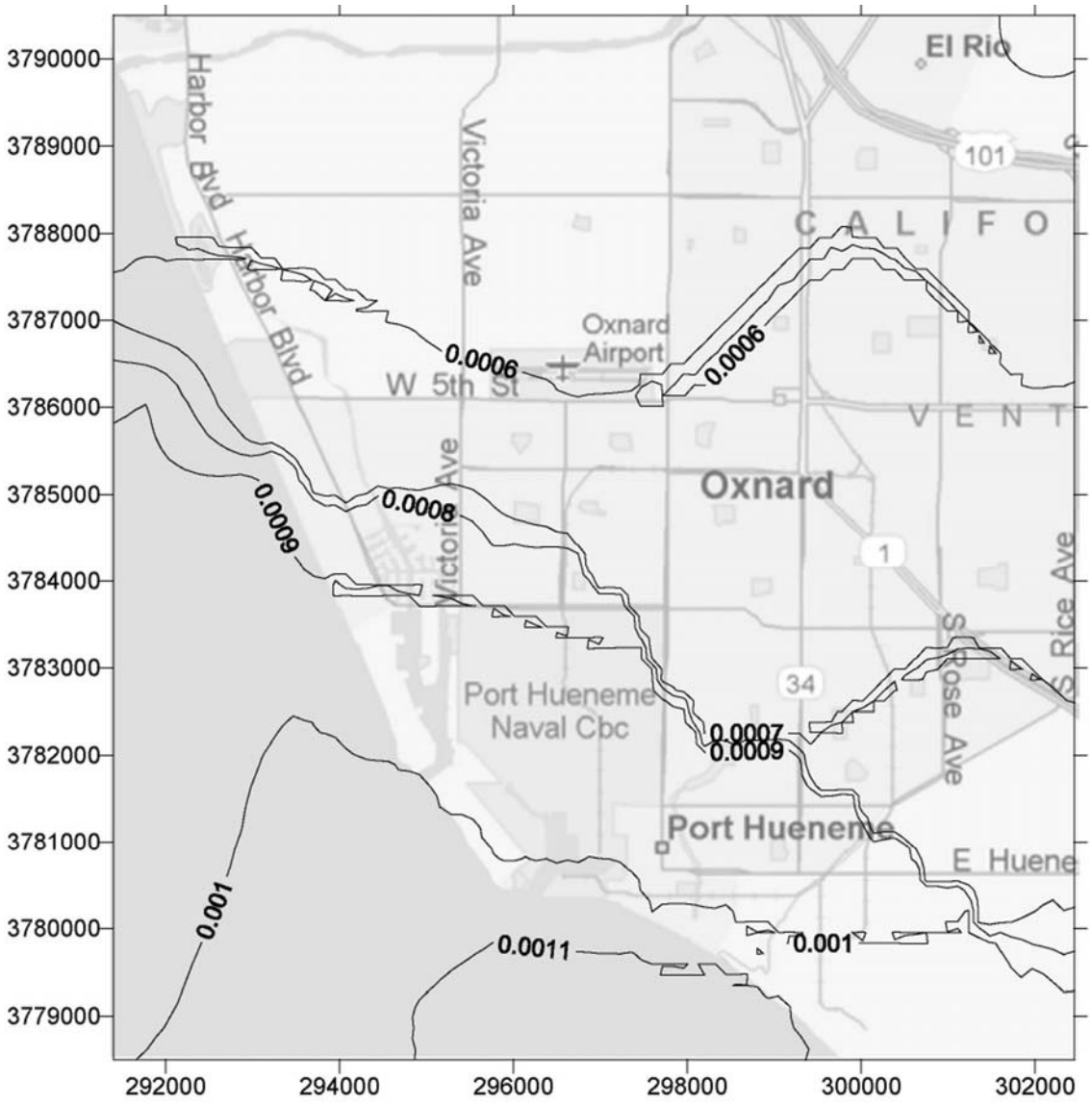
Note: Lines show contours of constant concentration; impacts are in units of $\mu g/m^3$.

Figure 1-5
BHP Cabrillo LNG Deepwater Port
24-hr Average PM_{10} Impacts: FSRU Sources Only
Modeled Impacts Over Oxnard Area



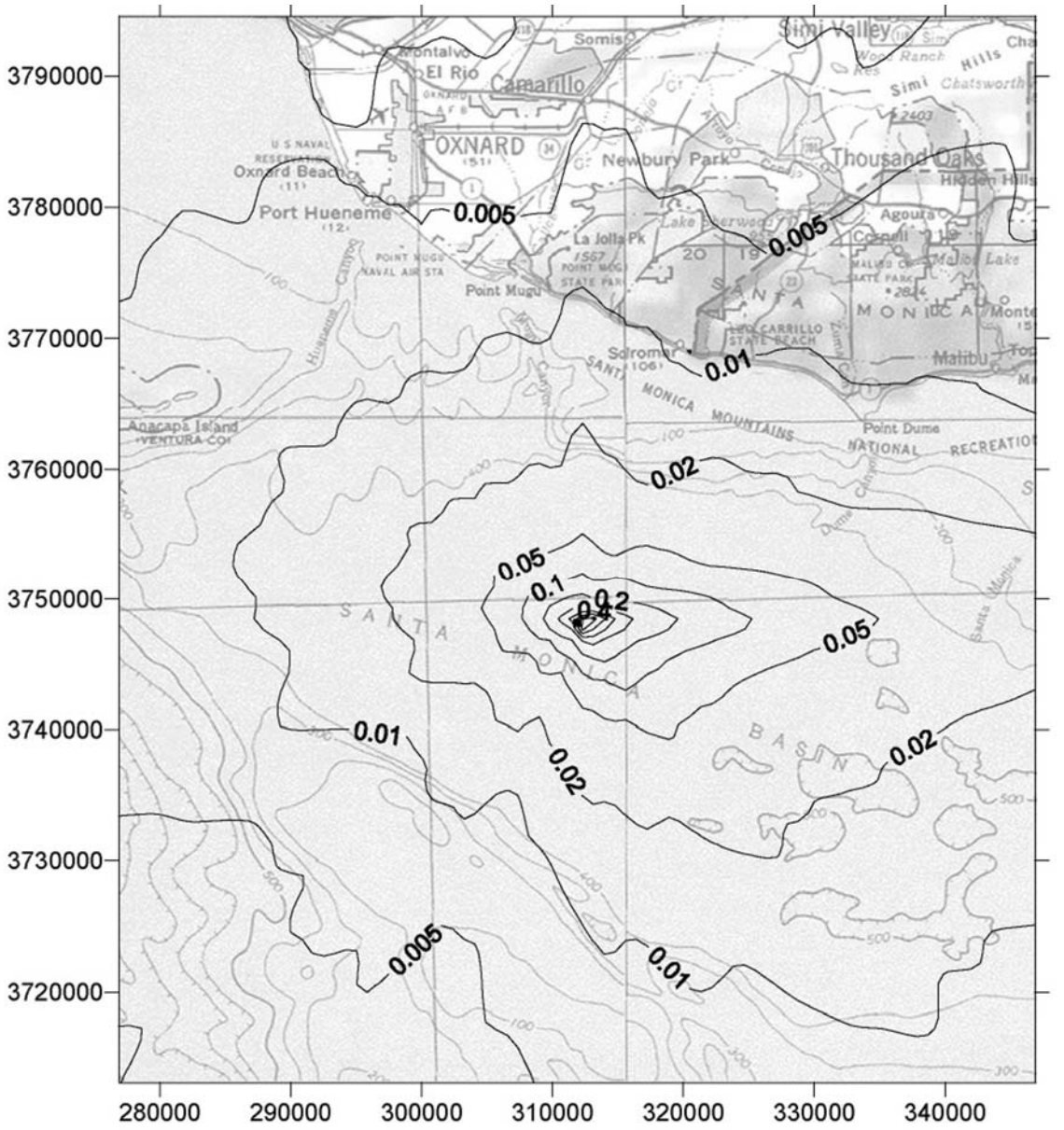
Note: Lines show contours of constant concentration; impacts are in units of $\mu g/m^3$.

Figure 1-6
BHP Cabrillo LNG Deepwater Port
Annual Average PM_{10} Impacts: FSRU Sources Only
Maximum Modeled Impacts Over Oxnard Area



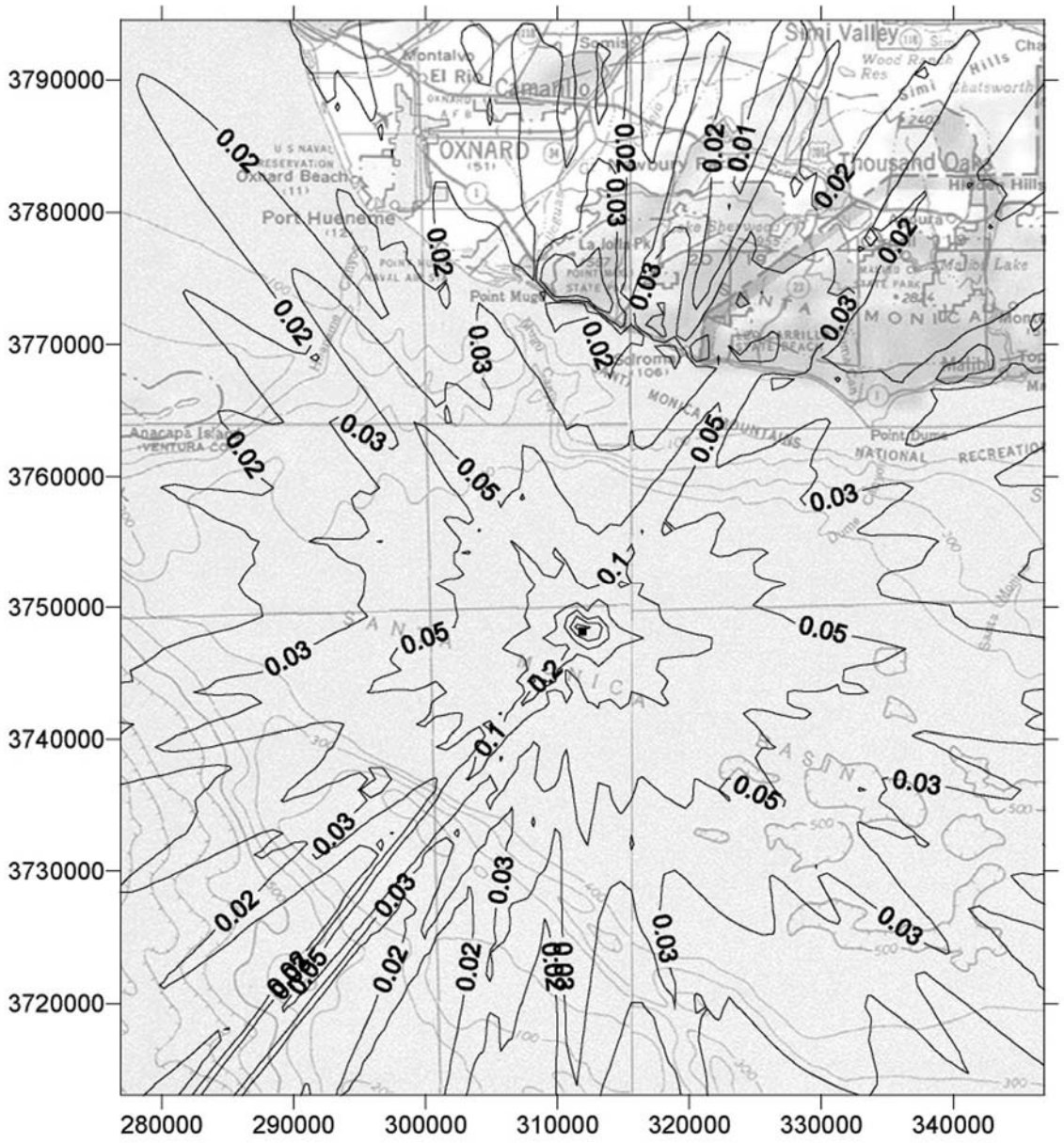
Note: Lines show contours of constant concentration; impacts are in units of $\mu g/m^3$.

Figure 1-7
BHP Cabrillo LNG Deepwater Port
Annual Average NO_2 Impacts: FSRU Sources and Marine Vessels
Maximum Modeled Impacts



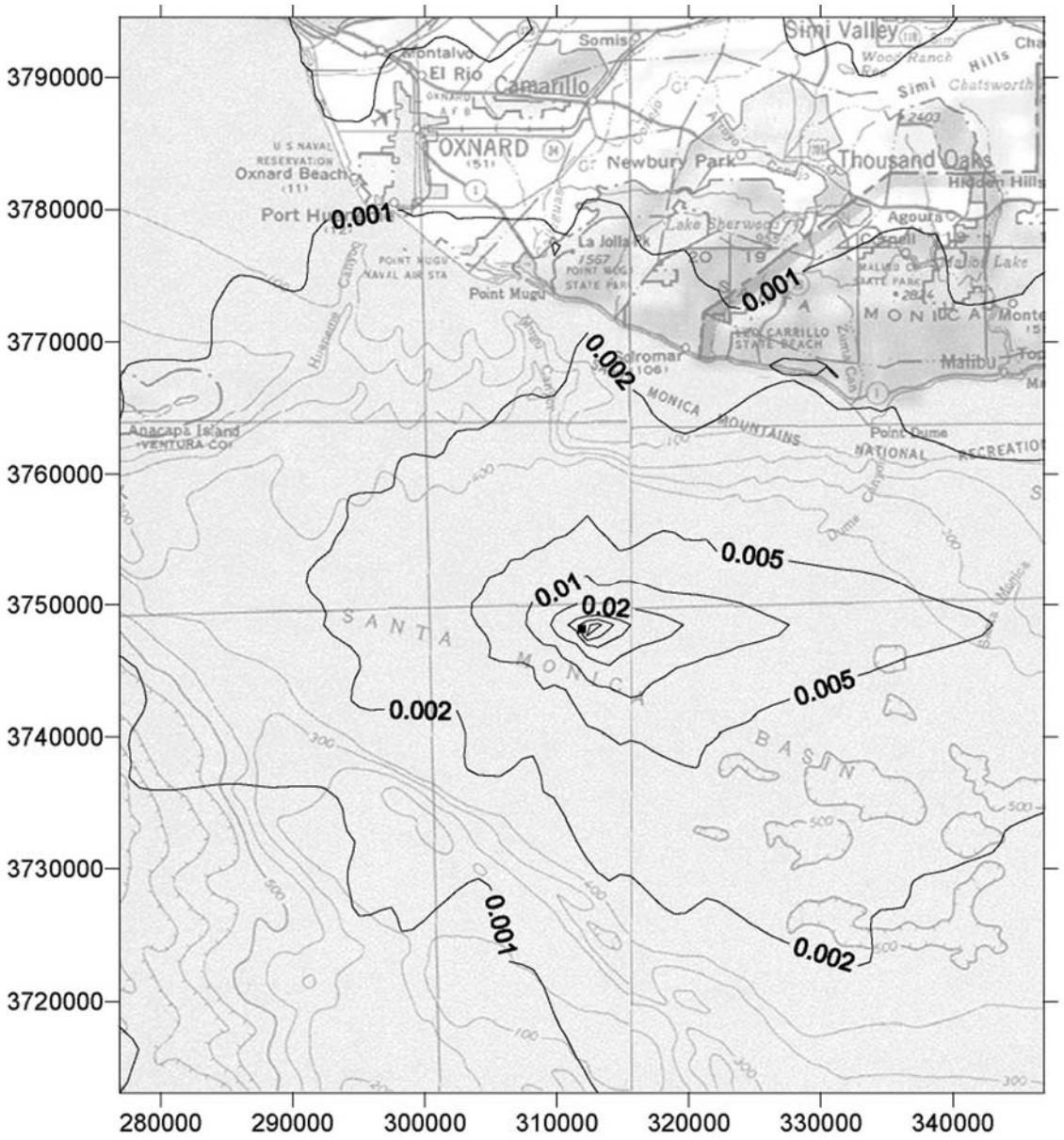
Note: Lines show contours of constant concentration; impacts are in units of $\mu g/m^3$.

Figure 1-8
BHP Cabrillo LNG Deepwater Port
24-hr Average PM_{10} Impacts: FSRU Sources and Marine Vessels
Maximum Modeled Impacts



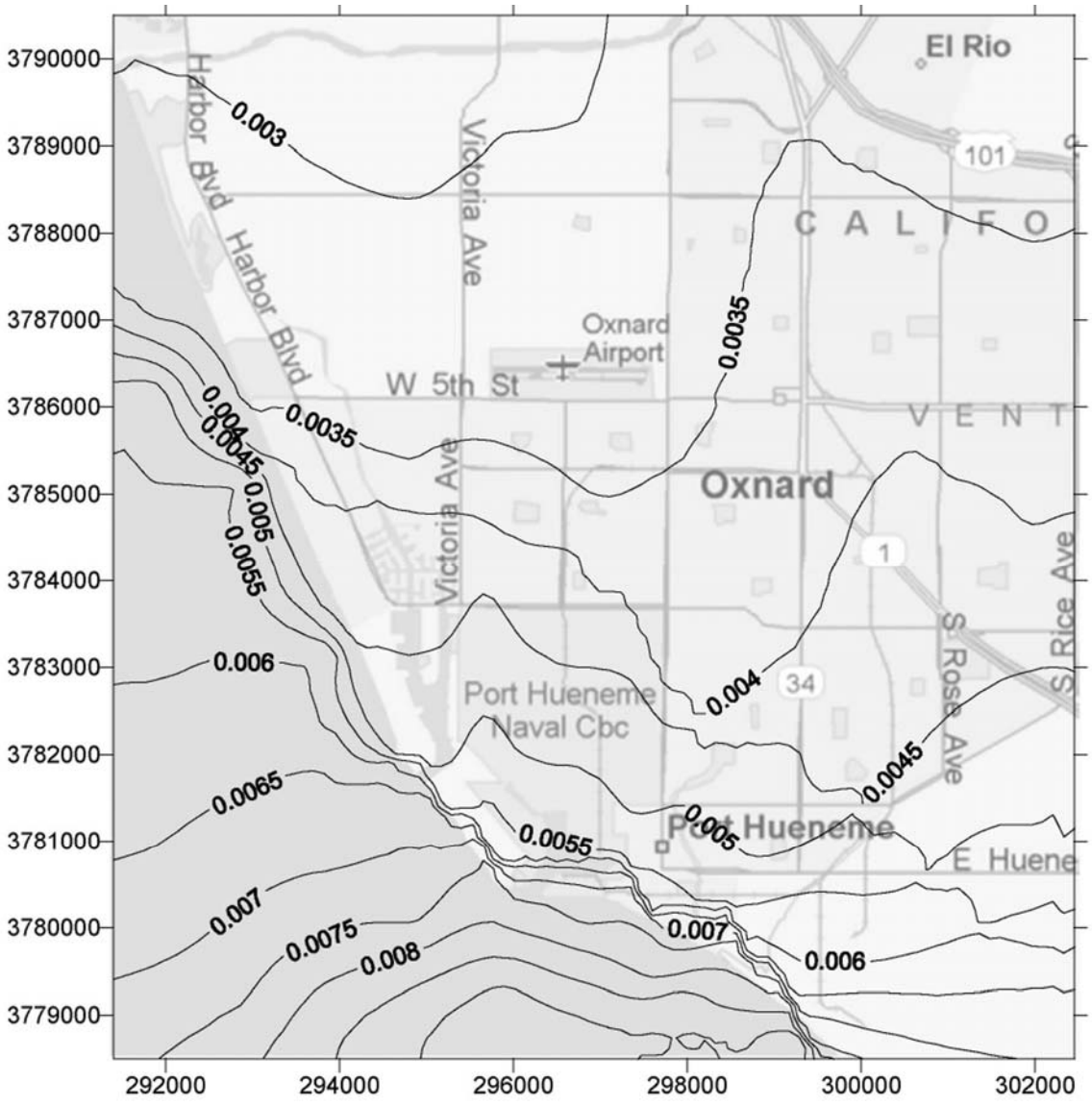
Note: Lines show contours of constant concentration; impacts are in units of $\mu g/m^3$.

Figure 1-9
BHP Cabrillo LNG Deepwater Port
Annual Average PM_{10} Impacts: FSRU Sources and Marine Vessels
Maximum Modeled Impact



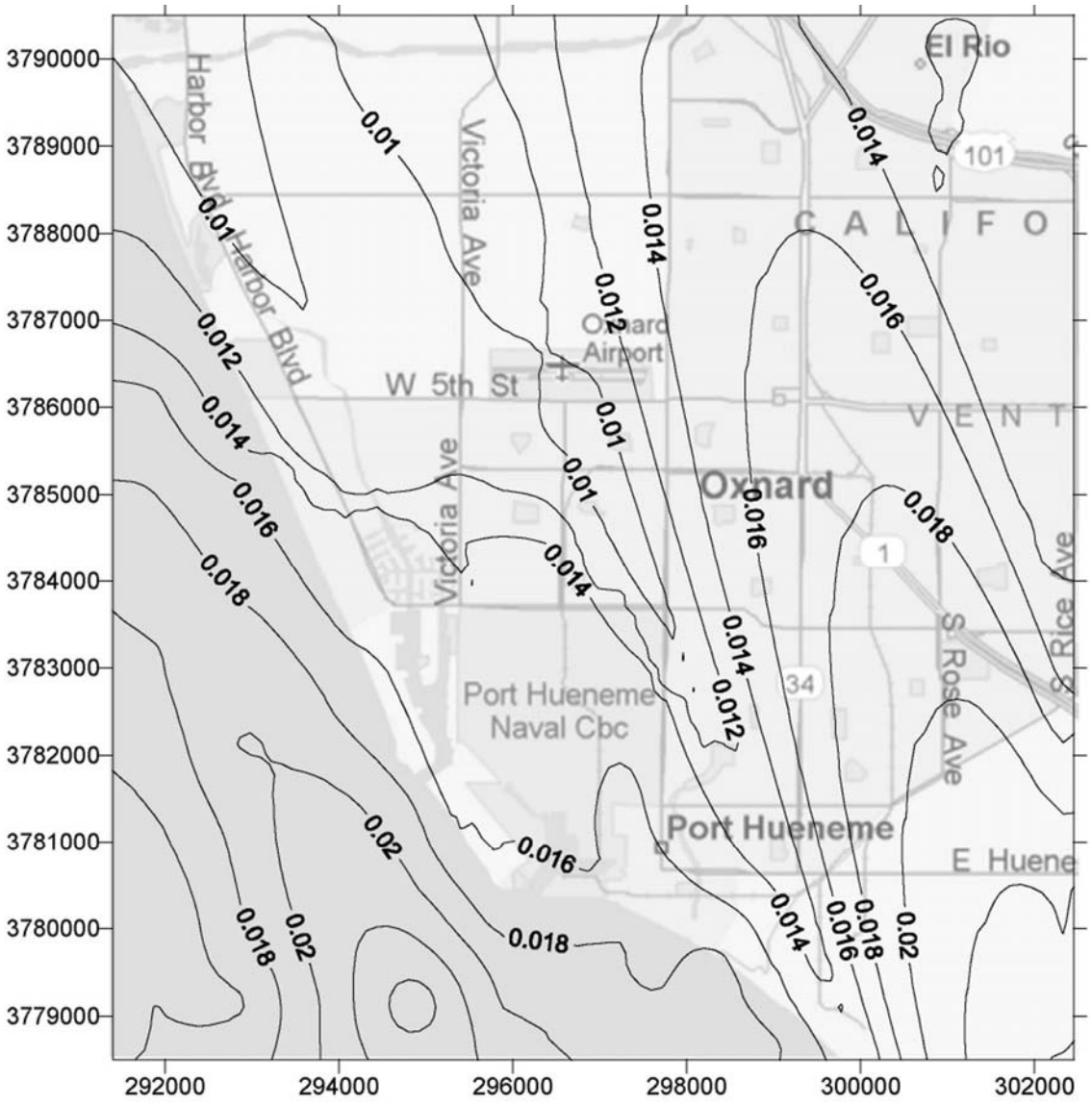
Note: Lines show contours of constant concentration; impacts are in units of $\mu g/m^3$.

Figure 1-10
BHP Cabrillo LNG Deepwater Port
Annual Average NO_2 Impacts: FSRU Sources and Marine Vessels
Maximum Modeled Impacts Over Oxnard Area



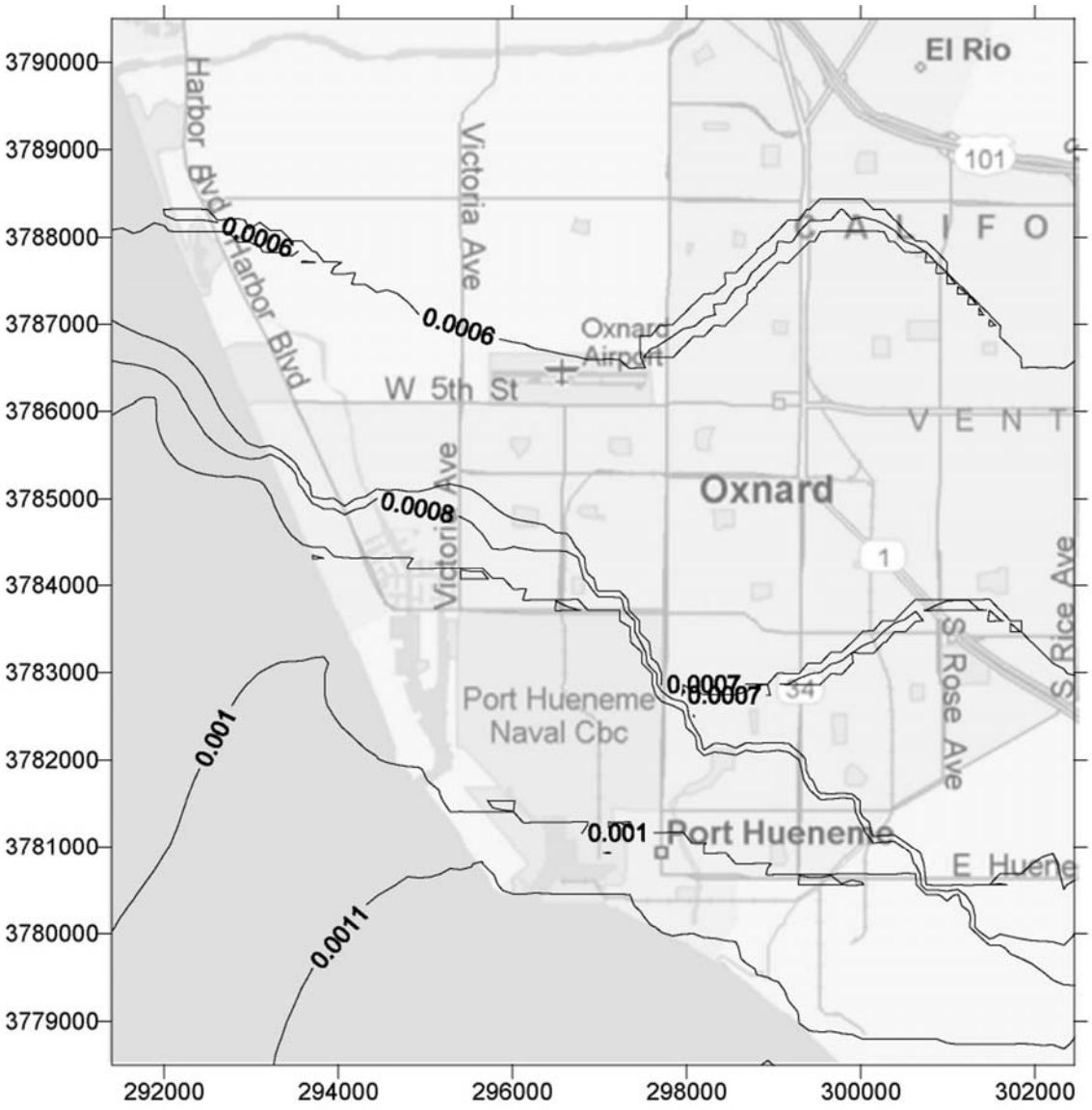
Note: Lines show contours of constant concentration; impacts are in units of $\mu g/m^3$.

Figure 1-11
BHP Cabrillo LNG Deepwater Port
24-hr Average PM_{10} Impacts: FSRU Sources and Marine Vessels
Maximum Modeled Impacts Over Oxnard Area



Note: Lines show contours of constant concentration; impacts are in units of $\mu g/m^3$.

Figure 1-12
BHP Cabrillo LNG Deepwater Port
Annual Average PM_{10} Impacts: FSRU Sources and Marine Vessels
Maximum Modeled Impacts Over Oxnard Area



Note: Lines show contours of constant concentration; impacts are in units of $\mu g/m^3$.

Figure 1-13
Receptors for Air Quality Impact Assessment
BHP Cabrillo LNG Deepwater Port

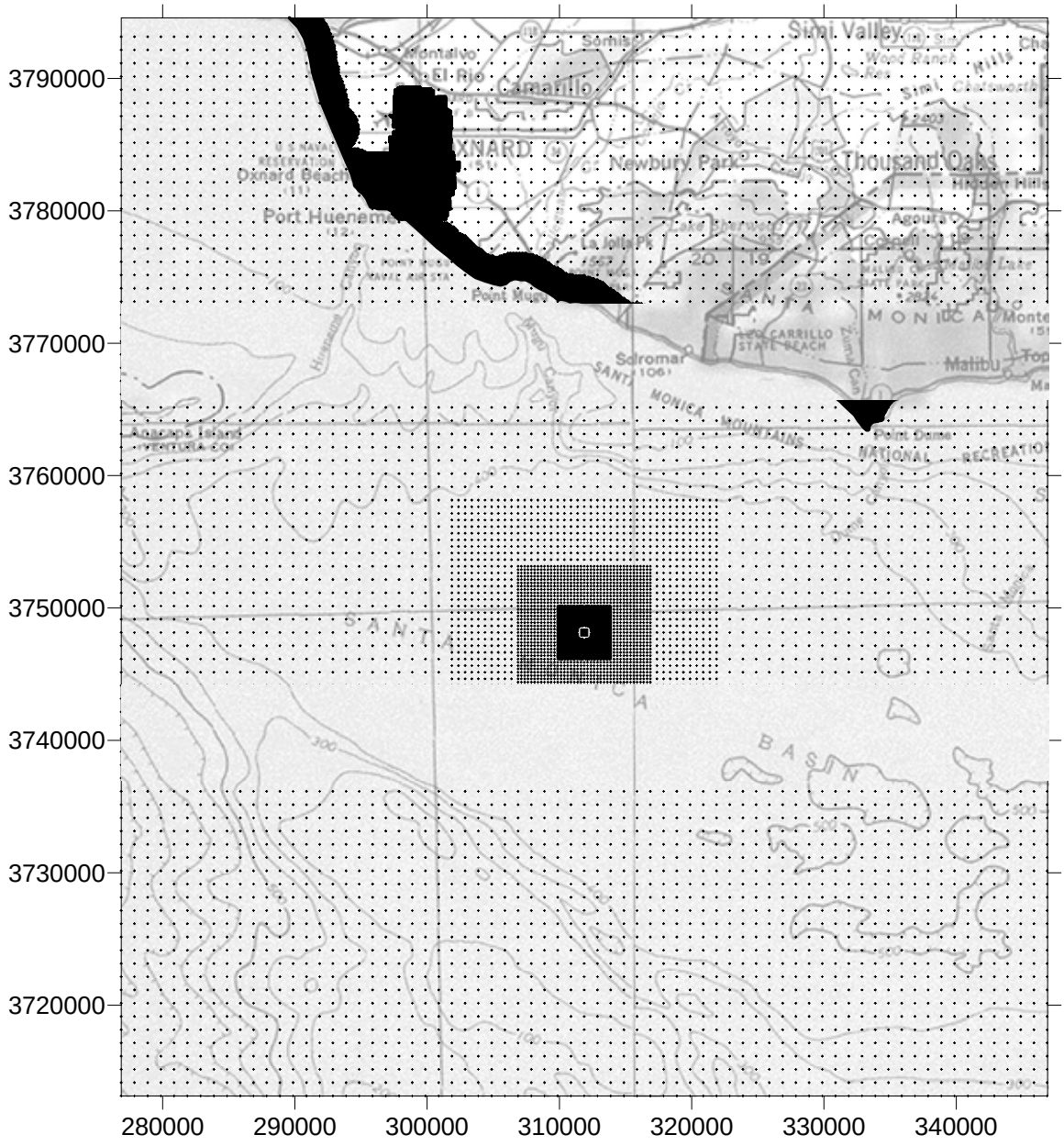


Figure 1-14
BHP Cabrillo LNG Deepwater Port
Locations of Receptors Used to Evaluate Project Impacts in the South Coast Air Basin

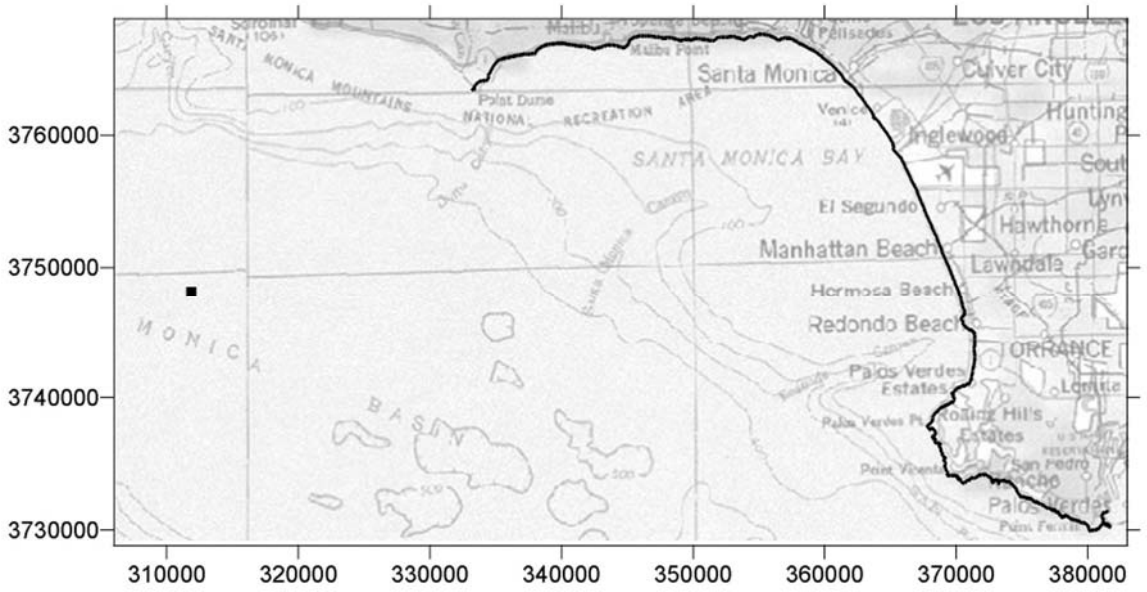


Figure 1-15
BHP Cabrillo LNG Deepwater Port
Annual Average NO2 Impacts: FSRU Sources Only
Maximum Modeled Impacts

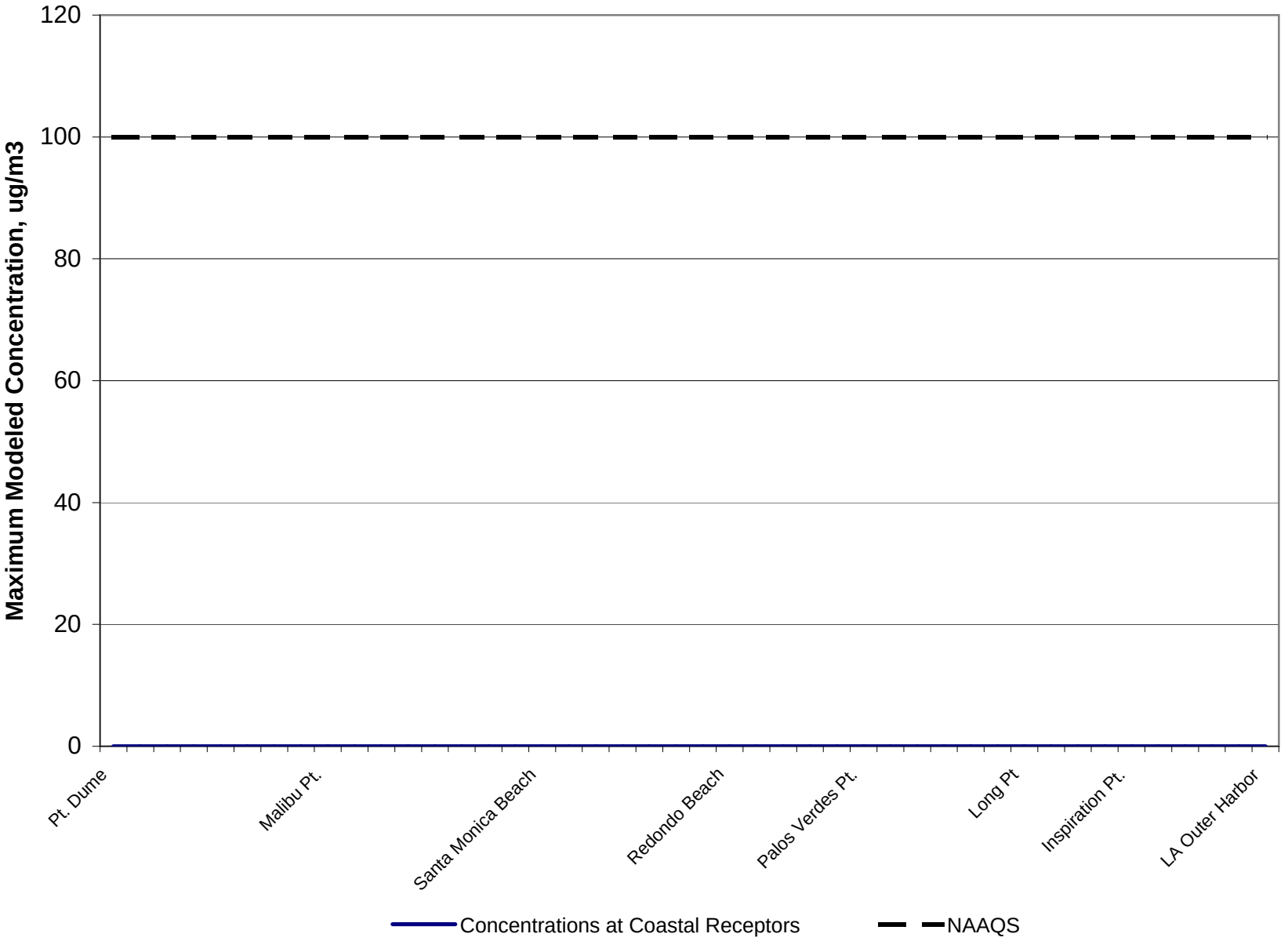


Figure 1-16
BHP Cabrillo LNG Deepwater Port
Annual Average NO2 Impacts: FSRU Sources and Marine Vessels
Maximum Modeled Impacts

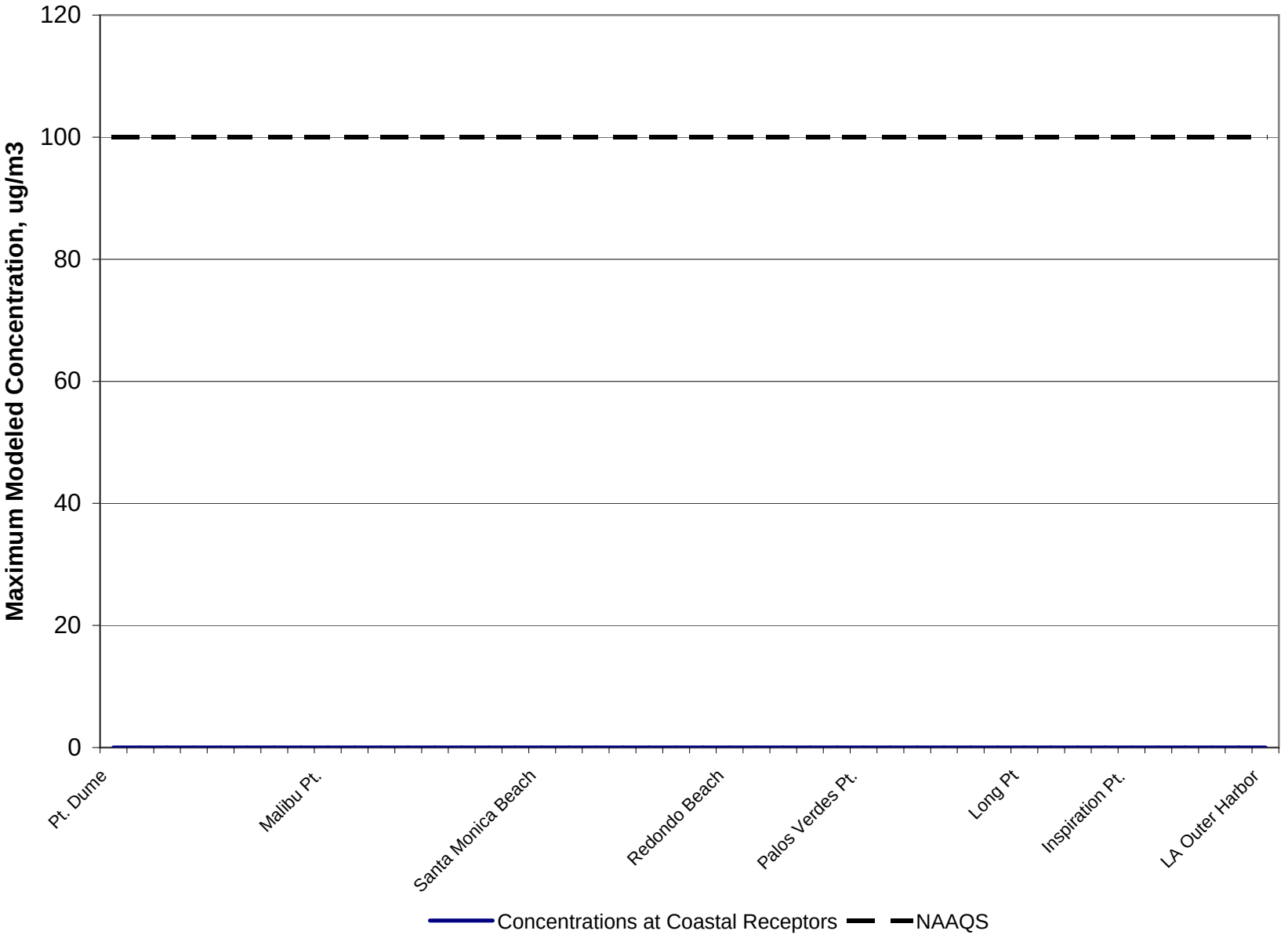


Figure 1-17
BHP Cabrillo LNG Deepwater Port
24-Hour Average PM10/PM2.5 Impacts: FSRU Sources Only
Maximum Modeled Impacts

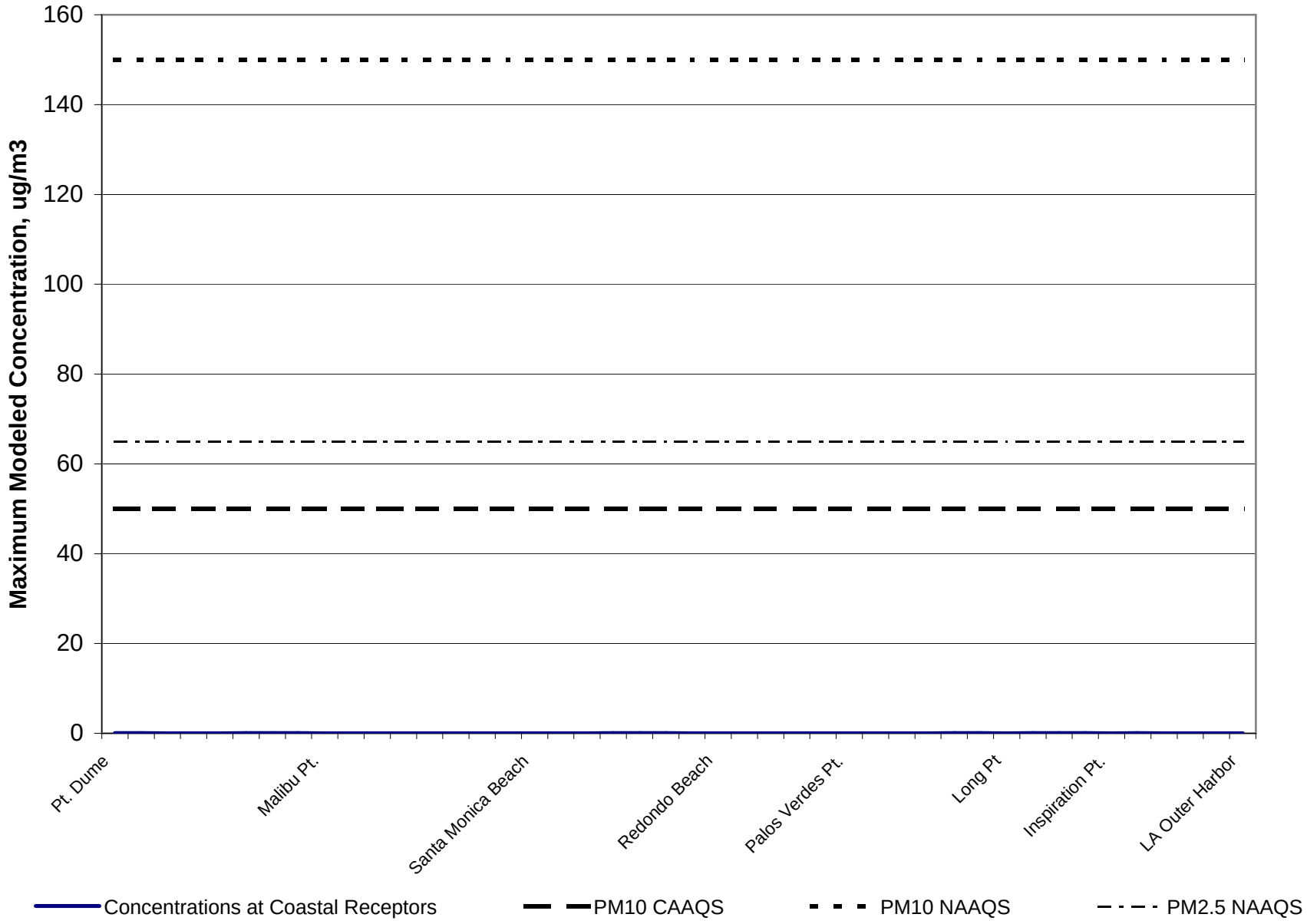


Figure 1-18
BHP Cabrillo LNG Deepwater Port
24-Hour Average PM10/PM2.5 Impacts: FSRU Sources and Marine Vessels
Maximum Modeled Impacts

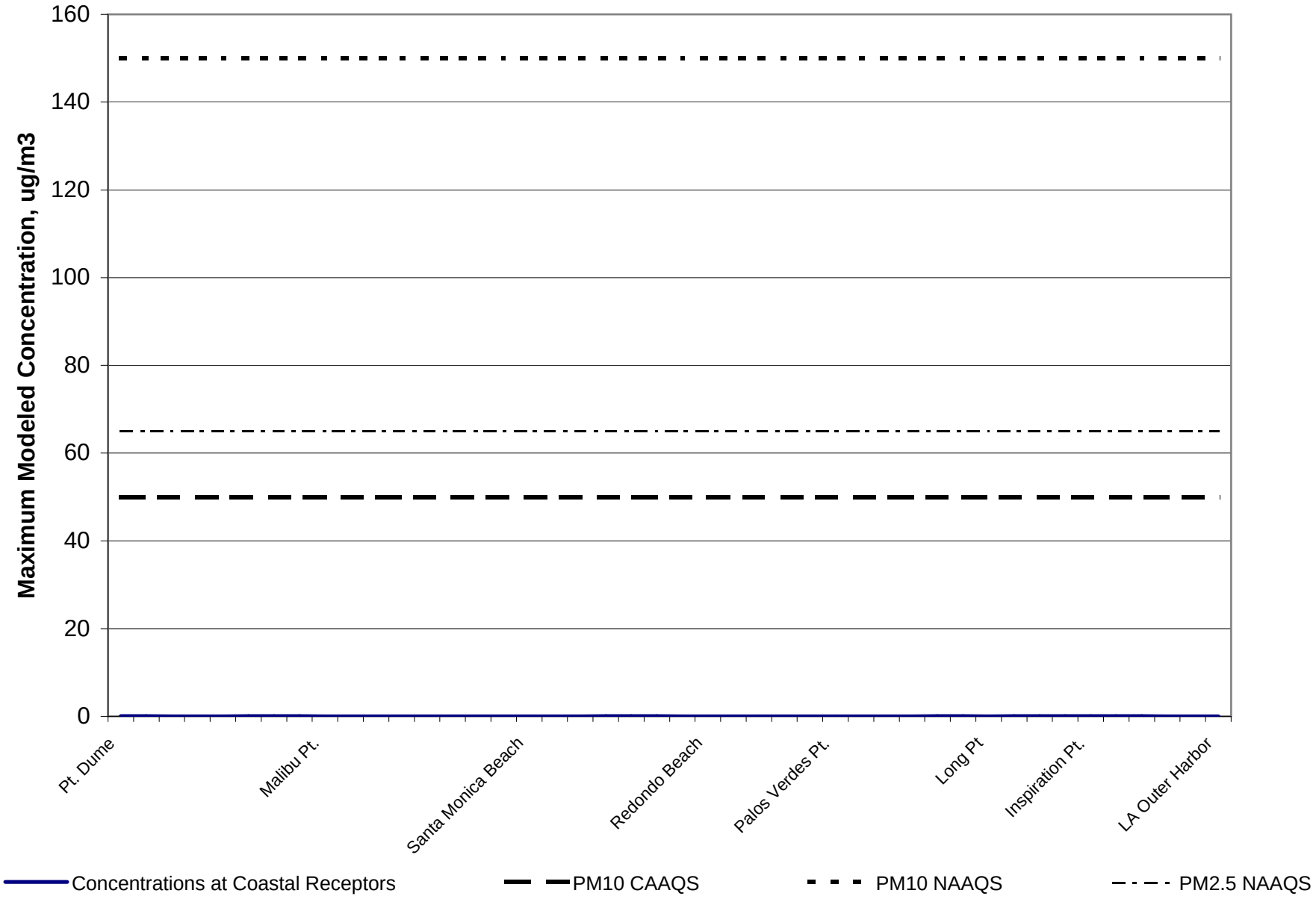


Figure 1-19
BHP Cabrillo LNG Deepwater Port
Annual Average PM10/PM2.5 Impacts: FSRU Sources Only
Maximum Modeled Impacts

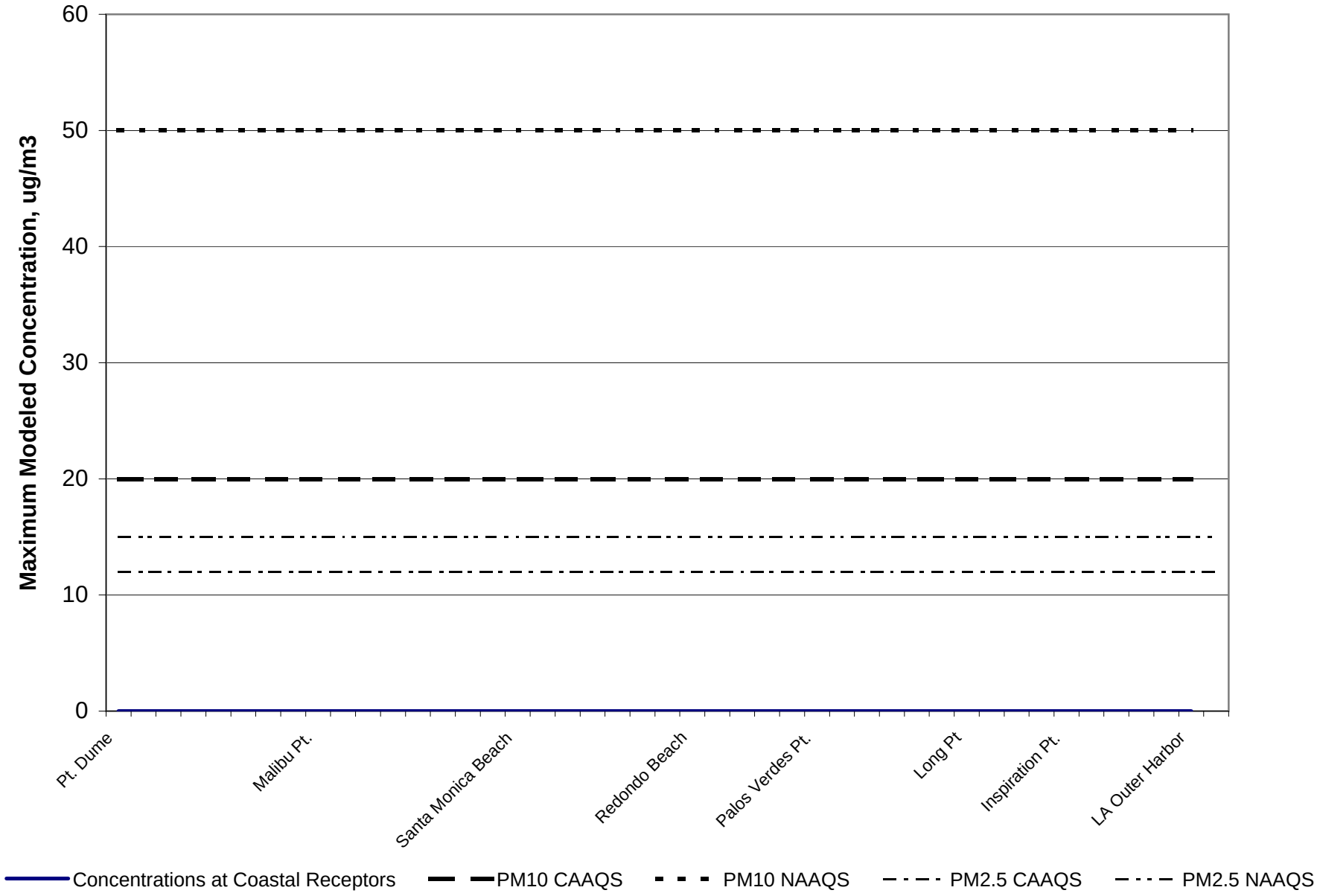


Figure 1-20
BHP Cabrillo LNG Deepwater Port
Annual Average PM10/PM2.5 Impacts: FSRU Sources and Marine Vessels
Maximum Modeled Impacts